

L Number	Hits	Search Text	DB	Time stamp
1	124590	(pore adj size or diameter or distribution).ab.	USPAT; US-PGPUB	2004/01/23 17:28
2	3579	(active adj material).ab.	USPAT; US-PGPUB	2004/01/23 17:26
3	158	((pore adj size or diameter or distribution).ab.) and ((active adj material).ab.)	USPAT; US-PGPUB	2004/01/23 17:26
4	247369	(pore adj size or diameter or distribution) same (support or substrate)	USPAT; US-PGPUB	2004/01/23 17:28
5	31	((pore adj size or diameter or distribution).ab.) and ((active adj material).ab.) and ((pore adj size or diameter or distribution) same (support or substrate))	USPAT; US-PGPUB	2004/01/23 17:27
6	10487	(pore adj (size or diameter or distribution)) same (support or substrate)	USPAT; US-PGPUB	2004/01/23 17:32
7	3370	(pore adj (size or diameter or distribution)).ab.	USPAT; US-PGPUB	2004/01/23 17:45
8	17	((pore adj (size or diameter or distribution)).ab.) and ((active adj material).ab.)	USPAT; US-PGPUB	2004/01/23 17:28
9	428	(pore adj (size or diameter or distribution)) same (active adj material)	USPAT; US-PGPUB	2004/01/23 17:33
10	162	((pore adj (size or diameter or distribution)) same (support or substrate)) and ((pore adj (size or diameter or distribution)) same (active adj material))	USPAT; US-PGPUB	2004/01/23 17:33
11	6012	(pore adj (size or diameter or distribution)) same different	USPAT; US-PGPUB	2004/01/23 17:33
12	43	((pore adj (size or diameter or distribution)) same different) and (((pore adj (size or diameter or distribution)) same (support or substrate)) and ((pore adj (size or diameter or distribution)) same (active adj material)))	USPAT; US-PGPUB	2004/01/23 17:40
13	1567	different adj pore	USPAT; US-PGPUB	2004/01/23 17:42
14	3	(((pore adj (size or diameter or distribution)) same (support or substrate)) and ((pore adj (size or diameter or distribution)) same (active adj material))) and (different adj pore))	USPAT; US-PGPUB	2004/01/23 17:41
15	281	first adj pore	USPAT; US-PGPUB	2004/01/23 17:41
16	3	(((pore adj (size or diameter or distribution)) same (support or substrate)) and ((pore adj (size or diameter or distribution)) same (active adj material))) and (first adj pore))	USPAT; US-PGPUB	2004/01/23 17:41
17	136	differing adj pore	USPAT; US-PGPUB	2004/01/23 17:42
18	36580	active adj material	USPAT; US-PGPUB	2004/01/23 17:42
19	2	(differing adj pore) and (active adj material)	USPAT; US-PGPUB	2004/01/23 17:43
20	1912	(different or differing or first) adj pore	USPAT; US-PGPUB	2004/01/23 17:44
21	6	((active adj material).ab.) and ((different or differing or first) adj pore)	USPAT; US-PGPUB	2004/01/23 17:44
22	1	("4,294,893").PN.	USPAT; US-PGPUB	2004/01/23 17:44
23	109	(active adj material) and ((different or differing or first) adj pore)	USPAT; US-PGPUB	2004/01/23 17:44
24	57115	(pore adj (size or diameter or distribution))	USPAT; US-PGPUB	2004/01/23 17:45
25	101	((active adj material) and ((different or differing or first) adj pore)) and ((pore adj (size or diameter or distribution)))	USPAT; US-PGPUB	2004/01/23 17:45
26	1397	((different or differing or first) adj pore adj (size or diameter or distribution))	USPAT; US-PGPUB	2004/01/23 17:52
27	81	(active adj material) and (((different or differing or first) adj pore adj (size or diameter or distribution)))	USPAT; US-PGPUB	2004/01/23 17:45

28	97	((different or differing or first) adj (size or diameter or distribution) adj pore)	USPAT; US-PGPUB	2004/01/23 17:51
29	4	(active adj material) and (((different or differing or first) adj (size or diameter or distribution) adj pore))	USPAT; US-PGPUB	2004/01/23 17:51
30	280	((different or differing or first) adj pore adj (size or diameter or distribution))	EPO; JPO; DERWENT	2004/01/23 17:53
31	35210	active adj material	EPO; JPO; DERWENT	2004/01/23 17:52
33	1	((different or differing or first) adj pore adj (size or diameter or distribution))) and (active adj material)	EPO; JPO; DERWENT	2004/01/23 17:53
34	26	((different or differing or first) adj (size or diameter or distribution) adj pore)	EPO; JPO; DERWENT	2004/01/23 17:53
35	0	(active adj material) and (((different or differing or first) adj (size or diameter or distribution) adj pore))	EPO; JPO; DERWENT	2004/01/23 17:54
37	23859	pore adj (size or diameter or distribution)	EPO; JPO; DERWENT	2004/01/23 17:54
38	219	(active adj material) and (pore adj (size or diameter or distribution))	EPO; JPO; DERWENT	2004/01/23 17:54
39	1	((active adj material) and (pore adj (size or diameter or distribution))) and ((difference or differing or first) adj pore)	EPO; JPO; DERWENT	2004/01/23 17:55


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## 7 entries found for *irradiate*.

**ir·ra·di·ate** 

Pronunciation Key (ɪ-rā'dē-āt')

v. **ir·ra·di·at·ed**, **ir·ra·di·at·ing**,  
**ir·ra·di·ates**  
v. *tr.*

1.

- a. To expose to radiation.
- b. To treat with radiation: *irradiate farm produce so as to destroy bacteria*.

2. To shed light on; illuminate.

3. To manifest in a manner suggesting the emission of light; radiate: *irradiate goodness*.

v. *intr.* Archaic

1. To send forth rays; radiate.
2. To become radiant.

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[Latin *irradiāre*, *irradiāt-*, *to illuminate*: *in-*, *on*; see **in-<sup>2</sup>** + *radiāre*, *to shine*; see **radiate**.]

**ir·ra·di·a·tive** *adj.*

**ir·ra·di·a·tor** *n.*

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## **irradiate**

P

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## **irradiate**

\Ir\*ra"di\*ate\, v. t. [imp. & p. p. Irradiated; p. pr. & vb. n. Irradiating.] [L. *irradiatus*, p. p. of *irradiare*. See In- in, and Radiate.] 1. To throw rays of light upon; to illuminate; to brighten; to adorn with luster.

Thy smile irradiates yon blue fields. --Sir W. Jones.

2. To enlighten intellectually; to illuminate; as, to irradiate the mind. --Bp. Bull.
3. To animate by heat or light. --Sir M. Hale.
4. To radiate, shed, or diffuse.

A splendid fa?ade, . . . irradiating hospitality.  
--H. James.

Source: Webster's Revised Unabridged Dictionary, © 1996,  
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### **irradiate**

\Ir\*ra"di\*ate\, v. i. To emit rays; to shine.

Source: Webster's Revised Unabridged Dictionary, © 1996,  
1998 MICRA, Inc.

### **irradiate**

\Ir\*ra"di\*ate\, a. [L. *irradiatus*, p. p.]  
Illuminated; irradiated. --Mason.

Source: Webster's Revised Unabridged Dictionary, © 1996,  
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### **irradiate**

v 1: give spiritual insight to; in religion [syn:  
enlighten] 2: cast rays of light upon 3: expose  
to radiation; "irradiate food" [syn: ray]

Source: WordNet ® 1.6, © 1997 Princeton University

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irradiate: in CancerWEB's On-line Medical  
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Medical Publishing & CancerWEB

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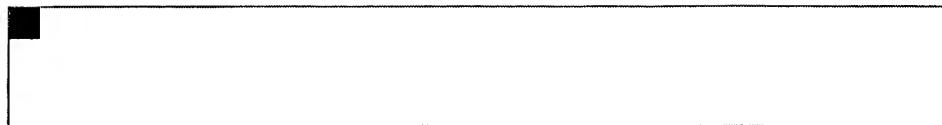
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### ir·ra·di·a·tion □

P

#### Pronunciation Key (ɪ-rā'dē-ə'shən)

n.

1. The act of exposing or the condition of being exposed to radiation.
2. The use or application of ionizing radiation, especially in medical treatment and for the sterilization or preservation of food.

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### irradiation

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## **irradiation**

\Ir\*ra`di\*a"tion\, n. [Cf. F. *irradiation*.] 1. Act  
of irradiating, or state of being irradiated.

2. Illumination; irradiance; brilliancy. --Sir W.  
Scott.

3. Fig.: Mental light or illumination. --Sir M.  
Hale.

4. (Opt.) The apparent enlargement of a bright  
object seen upon a dark ground, due to the  
fact that the portions of the retina around the  
image are stimulated by the intense light; as  
when a dark spot on a white ground appears  
smaller, or a white spot on a dark ground  
larger, than it really is, esp. when a little out of  
focus.

Source: *Webster's Revised Unabridged Dictionary*, © 1996,  
1998 MICRA, Inc.

## **irradiation**

n : the treatment of disease (especially  
cancer) by exposure to radiation [syn:  
radiotherapy, radiation therapy, actinotherapy]

Source: *WordNet* ® 1.6, © 1997 Princeton University

## **irradiation**

irradiation: in CancerWEB's On-line Medical  
Dictionary

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# PATENT ABSTRACTS OF JAPAN

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**H01M 10/12**

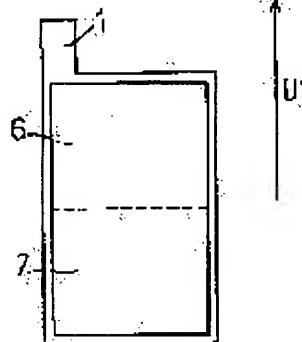
(21)Application number : **08-328688** (71)Applicant : **SHIN KOBE ELECTRIC MACH CO LTD**  
 (22)Date of filing : **09.12.1996** (72)Inventor : **OKAMOTO HIROKI**

## **(54) SEALED LEAD-ACID BATTERY**

### **(57)Abstract:**

**PROBLEM TO BE SOLVED:** To maintain charge/discharge in a lower part active material without pressing at high pressure an electrode group in the stacking direction, and gelling an electrolyte by making the mean pore size of a lower part active material layer locating in a lower part region larger than that of an upper part active material layer locating in an upper part region in the upper and lower direction of a positive plate, and adding a conducting additive to the lower part active material layer.

**SOLUTION:** An upper part active material layer 6 is formed in the upper part in the upper and lower direction of a positive plate, and a lower part active material layer 7 is formed in the lower part. The upper part active material layer 6 and the lower part active material layer 7 are formed so as to slightly cover inner bones. The lower part active material layer 7 has a mean pore size of 0.6 micron larger than that of the upper part active material layer 6 which has a mean pore size of 0.3 micron. Carbon is dispersed in the lower part active layer 7.



## **LEGAL STATUS**

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**DETAILED DESCRIPTION**

[Detailed Description of the Invention]

[0001]

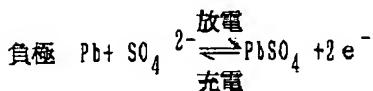
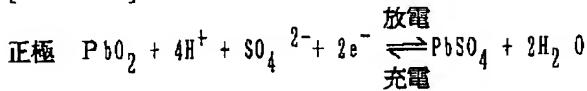
[The technical field to which invention belongs] This invention relates to a sealing form lead accumulator.

[0002]

[Description of the Prior Art] Generally the sealing form lead accumulator has the structure where the group of electrode by which the laminating was carried out through the electrolyte with which a positive-electrode board and a negative-electrode board consist of a retainer containing a dilute sulfuric acid (electrolytic solution) has been arranged in a battery case. Charge and discharge are repeated by the reaction formula showing this kind of sealing form lead accumulator below.

[0003]

[Formula 1]



As shown in the above-mentioned formula, water ( $\text{H}_2\text{O}$ ) arises from a positive-electrode board by discharge, and sulfate ion ( $\text{SO}_4^{2-}$ ) arises from a negative-electrode board by charge. Thereby, if charge and discharge are repeated by the cell, the so-called stratification-ized phenomenon in which the specific gravity of the electrolytic solution differs by the upper and lower sides of the vertical direction of a plate will arise between a plate and a retainer (crevice). When such a stratification-ized phenomenon arises, it compares with the up active material layer located in the up field on this lower active material layer in the lower active material layer located in the lower field of the vertical direction of a plate, and is  $\text{PbSO}_4$ . The amount of generation increases. An active material is  $\text{PbSO}_4$ . If it turns, for example with a positive-electrode board, volume will expand 1.9 times, and it will expand 2.7 times with a negative-electrode board. Therefore, the pore size in an active material layer becomes small, the electrolytic solution stops being able to permeate easily in an active material layer, and it is hard coming to generate a charge-and-discharge reaction in the lower active material layer of a plate. As for this, a charge product becomes is hard to be generated, and it is  $\text{PbSO}_4$ -izing advances further. Consequently,  $\text{PbSO}_4$  with conductivity low in charge and discharge concentrating on the upper part of a plate locally The conductivity of the lower active material layer of a plate falls, the capacity of a cell falls or a cycle life becomes short. Then, pressing a group of electrode with high voltage in the direction of a laminating, and sticking a plate and a retainer was examined. Since it is easy to produce a stratification-ized phenomenon in the crevice between a plate and a retainer, if a plate and a retainer are stuck, stratification-ization of the electrolytic solution can be prevented. Moreover, gelling or solating the electrolytic solution and controlling stratification-ization of the electrolytic solution was also examined. If the electrolytic solution is gelled or solated, migration in the vertical direction of water ( $\text{H}_2\text{O}$ ) or sulfate ion ( $\text{SO}_4^{2-}$ ) will be controlled.

[0004]

[Problem(s) to be Solved by the Invention] However, a group of electrode is inserted in a battery case by the cell which presses a group of electrode with high voltage in the direction of a laminating, and \*\*\*\*\* and the assembly nature of a cell are bad. Moreover, if a retainer is pressed with high voltage, the amount of electrolytic-solution maintenance of a retainer will fall, and the capacity of a cell will fall. Moreover, if the electrolytic solution is gelled or solated, since the diffusibility of the ion at the time of charge and discharge will be restricted, the capacity of a cell falls. Moreover, charge acceptance nature also falls.

[0005] The object of this invention maintains the charge-and-discharge reaction in a lower active material layer, without pressing a group of electrode with high voltage in the direction of a laminating, or gelling or solating the electrolytic solution, and a lower active material layer is  $\text{PbSO}_4$ . It is in offering the sealing form lead accumulator which can prevent remaining turning.

[0006]

[Means for Solving the Problem] The vertical direction in a busy condition is defined beforehand, and this invention is aimed at a sealing form lead accumulator using the electrolytic solution which has a fluidity as the electrolytic solution. in this invention, a lower active material layer located in a lower field of the vertical direction of a positive-electrode board at least attributes average pore size size compared with an up active material layer located in an up field on it. And a conductive additive is added to a lower active material layer.

[0007] Compared with an up active material layer to which a lower active material layer located in a lower field of the vertical direction of a plate if stratification-ization arises in the electrolytic solution is located in an up field on it, pore size in

an active material layer becomes small. So, in this invention, even if average pore size of a lower active material layer became small by enlarging beforehand average pore size of a lower active material layer compared with an up active material layer, it canceled that a big difference arose in pore size between an up active material layer and a lower active material layer. Therefore, the electrolytic solution permeates like [ a lower active material layer ] an up active material layer, a charge-and-discharge reaction in a lower active material layer is maintained, and a lower active material layer is PbSO<sub>4</sub>. It can prevent remaining turning. And it can prevent charge and discharge concentrating on the upper part of a plate locally. In addition, at this invention, a lower active material layer is PbSO<sub>4</sub>. Compared with a upside active material layer of that which can prevent remaining turning, it is conductive low PbSO<sub>4</sub>. A content becomes high a little. Then, it prevented making a lower active material layer contain a conductive additive, and conductivity of a lower active material layer falling. By the above, without according to this invention, pressing a group of electrode with high voltage in the direction of a laminating like before, or gelling or solating the electrolytic solution, capacity of a cell can fall or it can control efficiently that a cycle life becomes short. In addition, if porosity of an active material layer of both an up active material layer and a lower active material layer is raised, a charge-and-discharge reaction will concentrate on an up active material layer, and a cycle life will become short. Moreover, if a conductive additive is added to both active material layers, an active material fill will fall and capacity of a cell will fall.

[0008] Graphite, acetylene black, etc. can be used as a conductive additive.

[0009] A plate for sealing form lead accumulators of this invention is applicable to both a positive-electrode board and a negative-electrode board. However, compared with a negative-electrode board, a positive-electrode board has small pore, its porosity of a plate is low, since conductivity is low, when it applies to a positive-electrode board at least, capacity of a cell can fall or it can control that a cycle life becomes short.

[0010] Moreover, in a sealing form lead accumulator, although the electrolytic solution is made to absorb in a group of electrode, the isolation electrolytic solution which is not absorbed in a group of electrode will exist between a wall of a battery case, and a group of electrode actually. Therefore, when a group of electrode is arranged in a battery case and the electrolytic solution (dilute sulfuric acid) is poured in, in an active material layer of a portion corresponding to a field to which the isolation electrolytic solution of a plate exists, absorption of SO<sub>4</sub><sup>2-</sup> in the isolation electrolytic solution is promoted, and it is PbSO<sub>4</sub>. A weight ratio increases compared with an up active material layer. Therefore, even if it battery-case-degases or charges a cell after electrolytic-solution impregnation, a charge product is fully ungenerable (PbSO<sub>4</sub> remains remaining). Moreover, it sets to an active material layer of a portion corresponding to a field to which the isolation electrolytic solution of a plate exists for the following reason when charge and discharge are repeated by cell, and is PbSO<sub>4</sub>-izing progresses. when the isolation electrolytic solution does not exist, charge and discharge repeat on a cell -- having -- the electrolytic solution -- stratification-izing -- being generated -- PbSO<sub>4</sub> of a lower active material layer If-izing progresses until to some extent, SO<sub>4</sub><sup>2-</sup> in the electrolytic solution of the battery case lower part will be absorbed, it will decrease, and specific gravity of the electrolytic solution of the battery case lower part will become low. Therefore, PbSO<sub>4</sub> of a lower active material layer-izing decreases gradually. However, when the isolation electrolytic solution exists, absorption of SO<sub>4</sub><sup>2-</sup> in the isolation electrolytic solution continues, and it is PbSO<sub>4</sub> of a lower active material layer.-izing advances without decreasing.

[0011] Therefore, as for a lower active material layer, in a sealing form lead accumulator in which such the isolation electrolytic solution exists, it is desirable to form in a field (height more than height of the isolation electrolytic solution) to which the isolation electrolytic solution exists. thus, a thing for which the electrolytic solution (dilute sulfuric acid) will be poured in if constituted -- PbSO<sub>4</sub> of a lower active material layer of a plate a conductive additive with which a problem to which a weight ratio becomes large compared with an up active material layer is added by lower active material layer -- a battery case after electrolytic-solution impregnation -- it is solvable when charging efficiency of a lower active material layer improves by formation or charge. Moreover, charge and discharge are repeated by cell, stratification-ization arises in the electrolytic solution, and it is PbSO<sub>4</sub> of a lower active material layer. A problem on which-izing advances is solvable with an effect of both sides of containing a conductive additive in enlarging average pore size of a lower active material layer compared with an up active material layer, and a lower active material layer.

[0012] A plate of a sealing form lead accumulator of this invention fills up with and forms an active material paste in a grid-like charge collector, and it is [ a lower active material layer and an up active material layer ] desirable to form the enostosis section which forms a grid of a grid-like charge collector as the boundary section. Both can be clearly classified by the enostosis section, without mixing an up active material layer and a lower active material layer, if it does in this way. And it can prevent a crack etc. occurring on a boundary of an up active material layer and a lower active material layer.

[0013] When such a plate is adopted as a positive-electrode board side and carbon is used as a conductive additive, it is desirable to make average pore size of a lower active material layer into 1.5 to 2.0 times of average pore size of an up active material layer, and to make an amount of carbon into 0.1 - 0.5 % of the weight to lead powder which is the main raw material of an active material layer. If average pore size of a lower active material layer is less than 1.5 times of average pore size of an up active material layer, it is fully uncancelable that a big difference arises in pore size between an up active material layer and a lower active material layer. Moreover, when it exceeds 2.0 times, there is a problem that contraction of an active material is large and an active material becomes easy to be omitted. Moreover, if an amount of carbon is less than 0.1 % of the weight to lead powder which is the main raw material of an active material layer, conductivity of a lower active material layer cannot fully be raised. Moreover, if it exceeds 0.5 % of the weight, when an active material paste which can be applied cannot be obtained, for a wrap reason, capacity of a cell falls [ carbon ] an active material particle.

[0014]

#### [Embodiment of the Invention]

(An example 1 and example 1 of a comparison) The positive-electrode board of an example 1 was manufactured as follows. First, the well-known charge collector which consists of a grid object which has the handle part section 1 and the hyperostosis 2 like drawing 1 (A), and the enostosis 3 prolonged in a lengthwise direction and a longitudinal direction inside this hyperostosis 2 was prepared. As this charge collector shows to drawing 1 (B) which is the B-B line cross section of drawing 1 (A), the cross section has the rhombus and the enostosis 3 of the thickness size prolonged in the thickness direction of a charge collector is equal to the thickness size of the hyperostosis 2. Moreover, in this charge collector, the

direction where the handle part 1 shown in an arrow head U1 projects becomes above the vertical direction. And the upper part of central enostosis 3a prolonged in the center of a charge collector in the vertical direction U1 and the direction (longitudinal direction) which intersects perpendicularly will form the up active material restoration section 4, and the lower part of central enostosis 3a will form the lower active material restoration section 5. The lower active material restoration section 5 supports the field to which the isolation electrolytic solution (electrolytic solution which is not contained in a group of electrode) which exists between the wall of the battery case of the sealing form lead accumulator made behind and a group of electrode exists. Next, the charge collector was filled up with the active material paste with the active material paste continuation restoration equipment shown in drawing 2 . Active material paste continuation restoration equipment has the belt 101 and the active material paste restoration machine 102. A belt 101 advances in the direction of an arrow head, and two or more charge collector S-- is put in order so that the vertical direction of a charge collector S and the travelling direction of a belt 101 may intersect perpendicularly on it. The active material paste restoration machine 102 has the up active material paste restoration machine section 103 and the lower active material paste restoration machine section 104. The up active material paste restoration machine section 103 consists of up hopper 103a and restoration main part 103b which an up active material paste is sent from this up hopper 103a, and fills up the up active material restoration section 4 of a charge collector S with an up active material paste. The lower active material paste restoration machine section 104 consists of lower hopper 104a and restoration main part 104b which a lower active material paste is sent from this lower hopper 104a, and fills up the lower active material restoration machine section 5 of a charge collector S with a lower active material paste. An up active material paste and a lower active material paste are sent to up hopper 103a and lower hopper 104a from the active material paste manufacturing installation which is not illustrated, respectively. Restoration main part 103b and restoration main part 104b adjoin mutually so that the up active material restoration section 4 and the lower active material restoration section 5 can be filled up with an up active material paste and a lower active material paste bordering on central enostosis 3a at accuracy, respectively. A lower active material paste is an active material paste which can form average pore size greatly compared with the active material layer formed with an up active material paste at the time of active material layer formation, and moreover contains a conductive additive. This lower active material paste added, kneaded and made 15% of the weight of water to the dilute sulfuric acid and lead powder of 15% of the weight of specific gravity 1.300 (20 degrees C) to lead powder, after distributing the conductive additive which consists of 0.4% of the weight of carbon to the powder (only henceforth lead powder) and this lead powder containing metal lead of lead oxide and adding. The up active material paste added, kneaded and made 10% of the weight of water to the dilute sulfuric acid and lead powder of 15% of the weight of specific gravity 1.300 (20 degrees C) to the powder (only henceforth lead powder) and lead powder containing metal lead of lead oxide. In addition, the content of water performs adjustment of porosity. Porosity will become high if the content of water increases.

[0015] Thus, it can prevent preventing mixing with the upper part of central enostosis 3a of a charge collector and the up-by central enostosis 3a active material paste after restoration when it is caudad filled up with an up active material paste and a lower active material paste, respectively, and a lower active material paste, and a crack etc. occurring on the boundary of an up active material paste and a lower active material paste moreover. Therefore, omission of an active material can be prevented and the up active material layer and lower active material layer which are formed behind can be classified clearly.

[0016] next, the non-dried plate filled up with the active material paste -- the usual aging and after drying -- desiccation -- carrying out -- a height of 30cm, and width of face of 15cm -- un--- formation -- the positive-electrode board was made. next -- un--- formation -- the porosity of the active material layer of 20 positive-electrode boards and the upper and lower sides of the vertical direction was the same, the laminating of the 21 well-known negative-electrode boards which do not contain a conductive additive was carried out through the retainer which consists of a glass fiber, and the group of electrode was made. next -- since a group of electrode is arranged in a battery case -- the dilute sulfuric acid of specific gravity 1.220 (20 degrees C) -- pouring in -- one cel -- un--- formation -- the cell was made. At this time, the isolation electrolytic solution (electrolytic solution which is not contained in a group of electrode) which exists between the wall of the battery case of a sealing form lead accumulator and a group of electrode had the height of the one half of a positive-electrode board. That is, the lower active material restoration section 5 supports the portion in which the isolation electrolytic solution exists. next -- un--- formation -- battery case formation of the cell was carried out at the 220% of the amounts of electric charging for 45 hours, and the cell of 2V-500Ah was completed. Drawing 3 is the plan of the positive-electrode board arranged in a cell. As shown in this Fig., the up active material layer 6 is formed in the upper part of the vertical direction of a positive-electrode board, and the lower active material layer 7 is formed in the lower part. It is classified bordering on the portion corresponding to central enostosis 3a indicated to be the up active material layer 6 and the lower active material layer 7 to a dashed line.

Actually, the up active material layer 6 and the lower active material layer 7 are formed so that enostosis 3 may be covered slightly. Moreover, drawing 4 (A) is the enlarged view of the front face of the up active material layer 6, and drawing 4 (B) is the enlarged view of the front face of the lower active material layer 7. As shown in this Fig., pore 7a of the lower active material layer 7 has the magnitude of 0.6 micrometers of average pore size, and is greatly formed from pore 6a of the up active material layer 6 which has the magnitude of 0.3 micrometers of average pore size. Moreover, carbon 7b is distributed and contained in the lower active material layer 7. Thus, in this example, the average pore size of a lower active material layer was twice the average pore size of an up active material layer.

[0017] Next, the whole plate was filled up with the up active material paste and the same active material paste, and others made the positive-electrode board of this example and the example 1 of a comparison similarly contained by the cell. That is, the positive-electrode board of the example 1 of a comparison has pore size smaller than the average pore size of the lower active material layer 7 of the positive-electrode board of this example, and the active material layer which does not contain a conductive additive is formed in the whole plate. and a battery case -- formation -- PbSO [ almost as opposed to the active material / in / almost / a core / of a core and the plate lower part ]4 of the plate upper part of the positive-electrode board of this example after termination, and the example of a comparison The weight ratio was measured. In addition, these weight ratios are the averages of 21 positive-electrode boards in a cell. A table 1 shows the measurement result.

[0018]

[A table 1]

(単位 : %)

極板	実施例 1	比較例 1
上部	2. 3 3	2. 5 1
下部	3. 1 8	11. 7 2

this table -- setting -- PbSO<sub>4</sub> of the lower part of the positive-electrode board of the example of a comparison the reason the weight ratio is larger than the upper part -- the lower part of a positive-electrode board -- the isolation electrolytic solution -- the battery case from after electrolytic-solution impregnation -- while starting formation, it is because SO<sub>4</sub> 2- was absorbed so much. since the conductive additive contains in the lower active material layer 7 with the positive-electrode board of this example -- a battery case -- formation of formation -- effectiveness -- improving -- PbSO<sub>4</sub> It turns out that a weight ratio can be made small.

[0019] Next, after discharging for 3.5 hours by 0.2C (0.2C10) to the rate capacity of 10 time amount on the cell using the positive-electrode board of this example, and the cell using the positive-electrode board of the example of a comparison, the charge and discharge which charge for 4.5 hours by 0.2C (0.2C10) to the rate capacity of 10 time amount were repeated, respectively. And PbSO<sub>4</sub> [ almost as opposed to the active material / in / almost / a core (core of a lower active material layer) / of a core (core of an up active material layer), and the plate lower part ] of the plate upper part of the positive-electrode board of the example 1 in 50 cycle and 100 cycles, and the example 1 of a comparison The weight ratio was measured. A table 2 shows the measurement result.

[0020]

[A table 2]

(単位 : %)

サイクル	極板	実施例 1	比較例 1
50サイクル	上部	1. 9 8	1. 8 6
	下部	4. 7 5	27. 5
100サイクル	上部	2. 0 3	1. 5 3
	下部	7. 8 4	38. 7

It sets to this table and is PbSO<sub>4</sub> of the lower part of the positive-electrode board of the example of a comparison. If a weight ratio is larger than the upper part and the count of a cycle increases, the difference will become larger for stratification-ization of the electrolytic solution progressing from the charge and discharge of a cell. It is PbSO<sub>4</sub> of a lower active material layer by the both sides of containing a conductive additive with the positive-electrode board of this example in enlarging the average pore size of a lower active material layer compared with an up active material layer, and a lower active material layer. It turns out that a weight ratio can be made small.

[0021] Next, the content of the water of a lower active material paste was changed, the magnitude to the average pore size of the up active material layer of the average pore size of a lower active material layer was changed, and others made the cell which has arranged the positive-electrode board with which the ratios (average pore size ratio) to the average pore size of the up active material layer of the average pore size of a lower active material layer differ like this example inside. And PbSO<sub>4</sub> to the active material of the plate upper part after 50 cycles PbSO<sub>4</sub> to the active material of the plate lower part to a weight ratio The rate of a weight ratio and contraction of a lower active material layer were measured. Drawing 5 shows the measurement result. A thing with desirable carrying out by 1.5 to 2.0 times the average pore size of an up active material layer understands the average pore size of a lower part [ Fig. / this ] active material layer. When the average pore size of a lower active material layer is less than 1.5 times of the average pore size of an up active material layer, it cannot fully cancel that a big difference arises in pore size between an up active material layer and a lower active material layer, but is PbSO<sub>4</sub> of an up active material layer. PbSO<sub>4</sub> to a weight ratio of a lower active material layer A weight ratio becomes remarkably large. Moreover, if it exceeds 2.0 times, contraction of a lower active material layer will be large, and a battery life will become short.

[0022] Next, the amount of the carbon (conductive additive) to the lead powder which is the raw material of an active material layer was changed, and others made the cell which has arranged the positive-electrode board with which the amounts of carbon differ like this example inside. and a battery case -- formation -- PbSO<sub>4</sub> to the active material of the plate upper part after termination PbSO<sub>4</sub> to the active material of the plate lower part to a weight ratio The rate of a weight ratio and the discharge capacity factor of a cell were measured. Drawing 6 shows the measurement result. It is PbSO<sub>4</sub> of the plate lower part, without reducing discharge capacity greatly, if the amount of the carbon (conductive additive) to lead powder is carried out to 0.1 - 0.5% of the weight from this Fig. It turns out that a weight ratio can be made small.

[0023] (An example 2 and example 2 of a comparison) Drawing 7 is the plan of the positive-electrode board of an example 2. The positive-electrode board of this example is a positive-electrode board which made the direction shown in the arrow head U2 with which the handle part section 11 is located the upper part of the vertical direction using the same charge collector as what is shown in drawing 1 by making into the vertical direction the direction where the handle part section 11 projects, and the direction which intersects perpendicularly. With this positive-electrode board, the up active material layer 16 is formed above the central enostosis prolonged in the center of a charge collector in the vertical direction and the direction (longitudinal direction) which intersects perpendicularly, and the lower active material layer 17 is formed caudad. These up active material layer 16 and the lower active material layer 17 are formed, respectively with the same active material as the up active material layer 6 of a positive-electrode board and the lower active material layer 7 which are shown in drawing 3 . That is, pore of the lower active material layer 17 is formed more greatly than the pore of the up active

material layer 16 (to twice). Moreover, carbon is distributing in the lower active material layer 17. moreover, the positive-electrode board which shows these positive-electrode boards to drawing 3 -- the same -- a battery case -- it completed in the condition of having been arranged by formation in a cell. As specifically shown in drawing 8 , the group of electrode to which the laminating of the positive-electrode board 21 and the well-known negative-electrode board 22 which the porosity of the active material layer of the upper and lower sides of the vertical direction is the same, and does not contain a conductive additive was carried out through the retainer 23 is arranged and constituted in the battery case. In addition, in this Fig., 21a is a positive-electrode terminal prolonged from the strap which connects each positive-electrode handle part, and 22a is a negative-electrode terminal prolonged from the strap which connects each negative-electrode handle part.

[0024] Next, the whole plate was filled up with the up active material paste and the same active material paste, and others made the positive-electrode board of an example 2 and the example 2 of a comparison similarly contained by the cell. And PbSO<sub>4</sub> [ almost as opposed to the active material / in / almost / a core / of a core and the plate lower part ]4 of the plate upper part of the positive-electrode board of this example [ in / the same charge and discharge as the above-mentioned are repeated on each cell, and / 50 cycles and 100 cycles ], and the example of a comparison The table 3 which measured the weight ratio shows the measurement result.

[0025]

[A table 3]

(単位 : %)

サイクル	極板	実施例 2	比較例 2
50#イタム	上部	2. 0 3	1. 9 8
	下部	3. 3 6	1 3. 5 9
100#イタム	上部	1. 9 7	1. 3 2
	下部	3. 3 1	2 1. 6 8

It also sets for this example and is PbSO<sub>4</sub> of the lower part of the positive-electrode board of the example 2 of a comparison. If a weight ratio is larger than the upper part and the count of a cycle increases, that difference will become larger for stratification-ization of the electrolytic solution progressing from the charge and discharge of a cell. It is PbSO<sub>4</sub> of a lower active material layer by the both sides of containing a conductive additive in enlarging the average pore size of a lower active material layer compared with an up active material layer, and a lower active material layer like [ the positive-electrode board of an example 2 ] the positive-electrode board of an example 1. It turns out that a weight ratio can be made small.

[0026] In addition, although it is the example which applied this invention to the positive-electrode board in each above-mentioned example, even if it applies this invention to a negative-electrode board, it is PbSO<sub>4</sub> of a lower active material layer. Of course, a weight ratio can be made small.

[0027] Hereafter, the configuration of this invention indicated on the descriptions is indicated.

[0028] (1) After the up active material restoration section and the lower active material restoration section fill up with an active material paste said up active material restoration section of the charge collector which consists of a grid object classified by the bony septum, and said lower active material restoration section In the method of manufacturing the plate for sealing form lead accumulators with which an active material layer is formed and the vertical direction is defined in said lower active material restoration section The manufacture method of the plate for sealing form lead accumulators characterized by being filled up with the active material paste which can form average pore size greatly compared with the active material layer formed in said up active material restoration section at the time of active material layer formation, and moreover contains a conductive additive.

[0029] (2) After the up active material restoration section and the lower active material restoration section fill up with an active material paste said up active material restoration section of the charge collector which consists of a grid object classified by the bony septum, and said lower active material restoration section from an active material paste restoration machine In the method of manufacturing the plate for sealing form lead accumulators with which an active material layer is formed and the upper and lower sides are defined What has the up active material paste restoration machine section which fills up said up active material restoration section with an up active material paste, and the lower active material paste restoration machine section which fills up said lower active material restoration section with a lower active material paste as said active material paste restoration machine is used. As said lower active material paste The manufacture method of the plate for sealing form lead accumulators characterized by using the active material paste which can form average pore size greatly compared with the active material layer formed in said up active material restoration section at the time of active material layer formation, and moreover contains a conductive additive.

[0030]

[Effect of the Invention] According to this invention, the electrolytic solution permeates like [ a lower active material layer ] an up active material layer, the charge-and-discharge reaction in a lower active material layer is maintained, and a lower active material layer is PbSO<sub>4</sub>. It can prevent remaining turning. And it can prevent charge and discharge concentrating on the upper part of a plate locally. In addition, at this invention, a lower active material layer is PbSO<sub>4</sub>. Compared with the upside active material layer of that which can prevent remaining turning, it is conductive low PbSO<sub>4</sub>. A content becomes high a little. Then, it prevented making a lower active material layer contain a conductive additive, and the conductivity of a lower active material layer falling. By the above, compared with the case where according to this invention press a group of electrode with high voltage in the direction of a laminating like before, or the electrolytic solution is gelled or solated, the capacity of a cell can fall or it can control efficiently that a cycle life becomes short.

[Translation done.]

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CLAIMS

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[Claim(s)]

[Claim 1] A lower active material layer located in a lower field of a positive-electrode board up down [ said ] at least in a sealing form lead accumulator using the electrolytic solution which the vertical direction in a busy condition is defined beforehand, and has a fluidity as the electrolytic solution is a sealing form lead accumulator characterized by for average pore size to are large compared with an up active material layer located in an up field on it, and moreover for a conductive additive to be added by said lower active material layer.

[Claim 2] Said lower field is a sealing form lead accumulator according to claim 1 characterized by being the field where the isolation electrolytic solution exists.

[Claim 3] It is the sealing form lead accumulator according to claim 1 characterized by forming said lower active material layer and said up active material layer considering said enostosis section which forms a grid of said grid-like charge collector as the boundary section by filling up with an active material paste and forming a positive-electrode board in a grid-like charge collector at least.

[Claim 4] It is the sealing form lead accumulator according to claim 2 which average pore size of said lower active material layer of said positive-electrode board is 1.5 to 2.0 times the average pore size of said up active material layer, and said conductive additive is carbon, and is characterized by an amount of said carbon being 0.1 - 0.5 % of the weight to lead powder which is the main raw material of said active material layer.

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[Translation done.]

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TITLE: Airtight lead storage battery - contains lower active material layer and upper active material layer in top and bottom positions of electrode board with different pore sizes

PATENT-ASSIGNEE: SHIN KOBE ELECTRIC MACHINERY[KOBE]

PRIORITY-DATA: 1996JP-0328688 (December 9, 1996)

PATENT-FAMILY:

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INT-CL (IPC): H01M004/20, H01M010/12

ABSTRACTED-PUB-NO: JP 10172543A

BASIC-ABSTRACT:

The battery uses a liquid electrolyte and contains a lower active material layer (7) arranged in the bottom part of a positive electrode board and an upper active material layer (6) in the top part of the board. The average pore size of the lower active material layer is larger than the average pore size of the upper active material layer. An electroconductive additive is added in the bottom layer.

ADVANTAGE - The battery maintains charging and discharging in lower active material layer, prevents formation of lead sulphate in lower active material layer and improves cycle life.

CHOSEN-DRAWING: Dwg.3/8

TITLE-TERMS: AIRTIGHT LEAD STORAGE BATTERY CONTAIN LOWER ACTIVE MATERIAL LAYER

UPPER ACTIVE MATERIAL LAYER TOP BOTTOM POSITION ELECTRODE BOARD  
PORE SIZE

DERWENT-CLASS: L03 X16